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IDENTIFYING GIFTED STUDENTS IN ITALY: RELIABILITY AND VALIDITY OF THE ITALIAN VERSION OF THE GATES-2

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The term "gifted" refers to individuals who give evidence of higher performance in specific fields or domains considered relevant for his/her culture of origin. The teachers' opinion is a valuable aid in identifying giftedness, thanks to the privileged perspective from which they can observe students. The standardized assessment scales compiled by teachers are functional in a multi-informant and multi-method process of evaluation, because they are highly suitable for grasping the complexity that constitutes intellectual giftedness. The present study investigated the psychometric characteristics of the Italian version of the GATES-2, a tool to identify talented and gifted students, in a sample of 925 students, who participated in the Italian adaptation of the instrument. Statistical analyses were conducted to test internal consistency, score stability, and the discriminative validity. The excellent reliability and validity measures of the GATES-2 confirmed its usefulness in recognizing the talent of students. The GATES-2 represents an ideal aid, as it evaluates the five characteristics of giftedness recognized in national definitions.

Keywords: Giftedness; Talent; Teacher; Gates-2; School; Student.

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The term "gifted" refers to individuals who give evidence of higher performance capability in intellectual, creative, artistic, or leadership capacities, or in specific academic fields (Colangelo et al., 2004) or domains considered relevant for his/her culture of origin (Pfeiffer, 2013; Sternberg et al., 2011). In recent years, clinical and research attention on giftedness has grown in Italy, as evidenced by the increasing number of scientific publications (Cornoldi, 2019; Sartori & Cinque, 2019; Zanetti, 2017). The assessment of cognitive ability (through intelligence quotient [IQ] measurement) remains the main and often the only method adopted to identify gifted individuals (Carman, 2013), despite the existence of numerous concepts of giftedness, including those independent of IQ (Subotnik et al., 2011; Ziegler, 2005), and the definition of giftedness as a multidimensional construct (Heller et al., 2005; Renzulli & Reis, 2018). The identification of giftedness is a fundamental point in the enhancement of education for young people; among the sources of information, the teachers' opinion is a valuable aid in identifying giftedness, thanks to the privileged perspective from which they can observe students.

The use of standardized assessment scales and observation checklists compiled by teachers is very common internationally (Gilliam et al., 1996; Gilliam & Jerman, 2015; Pfeiffer & Jarosewich, 2003; Renzulli et al., 2002; Ryser & McConnell, 2004). These tools are functional in a multi-informant and multi-method process of evaluation, because they are highly suitable for grasping the complexity that constitutes intellectual giftedness (Eklund et al., 2015) and allow improvements in the quality of data collected via teachers by objectifying those data. However, such instruments are poorly documented in the literature. Among the most recently revised, the Scales for Rating the Behavioral Characteristics of Superior Students (SRBCSS; Renzulli et al. 2002) were developed to guide teachers in identifying specific student talents from kindergarten to the 12th grade. The Renzulli Scales are designed to obtain teacher estimates of a student's characteristics in the following areas: learning; creativity; motivation; leadership; artistic; musical; dramatics; communication; planning; mathematics; reading; technology and science. The SRBCSS manual does not provide statistical information about all scales; for instance, evidence of scale reliability is presented for intellectual, academic, creativity, and leadership subscales (Jarosewich et al., 2002).

The Gifted Rating Scales (GRS; Pfeiffer & Jarosewich, 2003) narrow the observation down to six areas, also including intellectual ability (reasoning, problem solving, and memory) and allow the identification of gifted and talented students only up to 13 years of age. Therefore, since they do not allow to evaluate the range of adolescents, they have not been considered sufficiently complete.

The Gifted and Talented Evaluation Scales (GATES; Gilliam et al., 1996) investigate talent and giftedness in five areas. However, the scales have a wider range of observation (from 5 to 18 years) and have recently been published in a revised second US edition (GATES-2; Gilliam & Jerman, 2015).

In a recent study, high correlations are described between GRS and GATES-2, as they assess similar constructs (Hemdan Mohamed, & Omara, 2020). Both scales show some advantages in the identification of gifted students: they are easy to administer, score, and interpret; the scores have acceptable reliability and validity; the scales can be used to measure students' strengths over time, which serves in program effectiveness; they can assist teachers in monitoring students' progress in relation to curriculum.

As there were no Italian adaptations of GRS scales, it was decided to proceed with the adaptation of the GATES-2 because the normative data were updated (normative data were collected in 2013 and 2014); the items were modified (22 items from the first edition were retained and 28 new items were added or revised); the reliability and validity characteristics have been improved, for example, the GATES-2 accurately differentiate students who are gifted and talented from those who are typically achieving (sensitivity = .84, specificity = .70, ROC/AUC = .84).

Therefore, the aim of this article is to describe the standardization work and psychometric characteristics of GATES-2, which is the first tool for the identification of gifted and talented students standardized for the Italian population. The reliability and validity characteristics of the test will be described; we expected to demonstrate that the GATES-2 have all the characteristics to be considered a useful and psychometrically adequate tool in the identification of intellectual giftedness.

METHOD

Participants

The sample was made up of 925 pupils (524 males and 401 females) aged between 5 and 18 years (*M* = 10.94; *SD* = 3.74), in relation to whom teachers from 21 comprehensive schools (kindergarten, primary, and secondary) in different provinces of Central Italy (Rome, Latina, L'Aquila, Pescara, Teramo, and Chieti) compiled the GATES-2 between January 2018 and February 2019. The sample was balanced by gender and age, and no statistically significant differences — $\chi^2(12) = 14.66$, $p = .26$; $V = .12$ — were found in the distribution of the sample based on gender. The mothers' age was between 24 and 63 years (*M* = 45.04, *SD* = 6.10 years), while fathers were aged between 27 and 68 years (*M* = 47.58, *SD* = 6.63 years). Table 1 illustrates the demographic characteristics of the sample. Subjects in the sample were born at 36.48 weeks of mean gestational age (*SD* = 1.99 weeks; range: 30–40 weeks); birth weights ranged between 1070g and 5000g (*M* = 3300g, *SD* = 490g). About 25% of the participants were an only child, but no statistically significant associations were found between being an only child and age, χ^2 (12) = 13.85, $p = .31$; $V = .15$, or gender, χ^2 (1) = .49, $p = .48$; $V = .03$.

TABLE 1
Description of the total sample (*N* = 925)

Demographic characteristics			*M* (*SD*); Range
Pupil age, in years, *M* (*SD*); range			10.94 (3.74); 5-18
Mother age, in years, *M* (*SD*); range			45.04 (6.10); 24-63
Father age, in years, *M* (*SD*); range			47.58 (6.63); 27-68
School attended	Pupil age *M* (*SD*); Range	Mother age *M* (*SD*); Range	Father age *M* (*SD*); Range
Kindergarten (*N* = 79)	5.56 (0.44); 5-6	36.70 (5.52); 24-47	40.20 (6.41); 27-62
Primary (*N* = 410)	8.40 (1.34); 6-11	43.64 (4.73); 28-54	46.18 (5.58); 32-67
Secondary I grade (*N* = 239)	12.56 (0.90); 10-15	44.55 (5.52); 31-53	47.56 (6.98); 35-65
Secondary II grade (*N* = 197)	16.45 (1.48); 14-18	49.11 (4.84); 35-63	51.35 (5.40); 36-68

Instruments

The Gifted and Talented Evaluation Scales, second edition (GATES-2; Gilliam & Jerman, 2015, Italian adaptation by Bianchi di Castelbianco et al., 2019) is a standardized rating scale, a method of gathering information to assist in the identification of gifted and talented students from 5 to 18 years of age. The test provides the teachers, the parents, or others who have contact with the student, to summarize their perception of the students' skills, observable in the school context. The GATES-2, based on the most current definitions of giftedness, has five subscales and each subscale has 10 items: general intellectual ability, academic skills, creativity, leadership, and artistic talent. The general intellectual ability subscale investigates how the student thinks and reflects, evaluating abstract learning, problem solving, knowledge of current events, and memory. Examples of items included in this scale are: "Sees connections and grasps relationship between stimuli and concepts" or "Solves difficult and unique problems." The academic skills subscale investigates the presence of high levels of student competence in reading, understanding of texts, calculation or, for preschool children, in the ability to learn with a few instructions and to understand complex material. Examples of items: "Grade reading level is ..." or "Correctly answers inferential questions." The creativity subscale evaluates the student's ability to create new ideas, inventions, discoveries and original results in one or more learning areas; it also evaluates the problem solving style, the flexibility of reasoning, the presence of active imagination, and preference for alternative solutions. Examples of item: "Applies unique solutions to problems" or "Expresses unique and innovative and methods." The leadership subscale evaluates the student's ability to take the leading role, to propose ideas, activities or solutions, and coordinate others; it also assesses the ability to act responsibly, show self-control, and inspire confidence. Examples of item: "Has a cooperative attitude" or "Works effectively with peers." The artistic talent subscale evaluates the student's attitudes to the arts, such as acting, music, singing, dance, drawing, painting, sculpture, and so forth. Examples of item: "Studies or practices artistic skills without being told" or "Demonstrates innovation and creativity in performing."

The 50 items describe specific, observable, and measurable behaviors through a 9-point Likert scale, based on comparison to same-aged peers: the respondent has to decide whether the student is below average (1, 2 ,3), average (4, 5, 6), or above average (7, 8, 9) with respect to the characteristic described in each item. The scale can be completed within 10-20 minutes. Total scores are converted into percentile ranks and standard scores. Standard scores above 110 indicate a high probability that the student is gifted and talented. Scores between 85 and 110, for the general intellectual ability and academic skills subscales, and between 90 and 110, for the creativity, leadership, and artistic talent subscales, indicate an average probability that the student is gifted and talented.

The original US version of the GATES-2 (Gilliam, & Jerman, 2015) was standardized on a sample of students who had been identified as gifted by their school discrict, and it has good reliability and validity: average coefficient alphas are .97 for general intellectual ability, .96 for academic skills, creativity, and leadership, and .98 for the artistic talent; the test-retest coefficients range from .88 to .91; the intraclass correlation coefficients (ICC), used to measure interrater reliability, range from .78 to .93; the median correlation with criterion measures is .75.

The Colored Progressive Matrices (CPM; Raven, 2003, Italian adaptation by Belacchi et al., 2008) are internationally recognized as a culture-fair test of nonverbal intelligence. They were designed for children aged 3 through 11 years old and consist of three series of 12 items each, composed in such a way as to measure the main processes characteristic of this age group. This test highlights abstract reasoning and fluid intelligence with good levels of reliability (Cronbach's alpha from .71 to .90).

Cattell's Fluid Intelligence Test, Scale 2 (CFT 20-R; Weiß, 2007, Italian adaptation by Saggino & Tommasi, 2019) measures nonverbal intelligence regardless of the cultural level in children and adolescents aged from 8 to 18 years old. The test consists of two series, both include four subtests: series continuation, classification, matrices, topological conclusions. The raw scores are transformed into IQ scores with mean 100 and standard deviation 15. The reliability of the test is good (r = .87).

The Wechsler scales measure the cognitive abilities of children and adults. In the present research, children under the age of six were administered the Wechsler Preschool and Primary Scale of Intelligence - Third Edition (WPPSI-III, Wechsler, 2002, Italian adaptation by Sannio Fancello & Cianchetti, 2008). The Wechsler Intelligence Scale for Children - Fourth Edition (WISC-IV, Wechsler, 2003, Italian adaptation by Orsini et al., 2012) was administered to children from six to 16 years old in order to provide an overall measure of general intellectual ability (FSIQ) and four composite scores which measure specific cognitive domains (verbal comprehension, perceptual reasoning, working memory, processing speed). Subjects over the age of 16 were administered the Wechsler Adult Intelligence Scale - Fourth Edition (WAIS-IV;

Wechsler, 2008, Italian adaptation by Orsini & Pezzuti, 2013), which allows the overall assessment of cognitive abilities of adolescents and adults aged between 16 and 90 years old. It provides a full scale IQ (FSIQ), representative of general intellectual ability, and four composite scores (the same as those obtained with the WISC-IV).

Procedures

The recruitment of the sample was carried out in kindergarten, primary, first-, and second-grade secondary schools. The schools were invited to participate in a research project by the Institute of Ortofonologia, entitled “Identification of high-potential pupils.” No specific selection was made in the recruitment of participants; that is, not only children and young people suspected of having high intellectual potential were selected but, unlike the tests carried out by the US authors of GATES-2, all pupils whose families and schools joined the project were included in the Italian standardization. We wanted to ensure a greater representativeness of the sample with respect to the population of Italian students in its entirety.

After the head teacher and teachers had joined the project, informed consent was given to both parents providing information about the objectives of the research, data processing, and privacy for the participation of children in the research. Parents also had to fill in an anamnestic questionnaire in which socio-demographic and clinical information was collected. At the end of the research, a report explaining the results was given to each of the families and schools.

The research occurred in the following phases: first, all pupils ranging in age from 5 to 7 years, were administered the CPM (Raven, 2003) while those ranging in age from 8 to 18 years were given the CFT 20-R scales (Weiß, 2007) for nonverbal reasoning. Second, teachers were asked to complete the GATES-2 (Gilliam & Jerman, 2015) to identify areas of potentiality, and a randomly selected subgroup of teachers were asked to fill in the questionnaires a second time, no later than 30 days after the first compilation. Third, only pupils who were found to have high potential during their assessments in direct (CPM and CFT 20-R) or indirect (GATES-2) evaluation, were offered an in-depth study of their IQ, through the Wechsler scales.

Statistical Analyses

Test-retest reliability was evaluated with Pearson correlations, and paired sample *t*-tests were also conducted on participant responses to assess raw scale score stability. To evaluate the internal consistency and the discriminative capacity of GATES-2 items, the split-half method was used, D-index was calculated, and confirmatory factor analysis was conducted. In order to evaluate criterion-related validity, Pearson correlations, ANOVA, and MANOVA analyses of variance were conducted. The level of significance was set at $p < .05$. All statistical analyses were performed using the software version 21.0 of SPSS.

Results

Psychometric Characteristics of the GATES-2 Scales: Reliability

The significant discriminative capacity of the item emerged from the item analysis of the Italian sample, divided by gender. The GATES-2 is a 9-point Likert scale, so the mean value is 5 and the acceptable values are between 3.5 and 6.5. In all five subscales, the mean values ranged from 5.02 to 5.97. The level of difficulty of the items was also calculated (D-index), which confirmed the good discriminative capacity of the items in the five subscales, as the values were all lower than $p < .05$. Finally, the corrected item-total correlation was calculated and found to be high in all five subscales (from .78 to .95; see Table 2).

TABLE 2
Item analysis in the total sample (N = 925)

Item General intellectual ability	Skewness	Kurtosis	D-index	Corrected item-total correlation
1	.08	–.15	< .001	.93
2	.04	–.08	< .001	.95
3	.05	–.10	< .001	.95
4	.10	–.22	< .001	.92
5	.01	–.08	< .001	.91
6	.12	–.16	< .001	.94
7	.11	–.15	< .001	.95
8	.10	–.12	< .001	.92
9	.13	–.17	< .001	.93
10	.16	–.33	< .001	.90
Academic skills	Skewness	Kurtosis	D-index	Corrected item-total correlation
11	.12	–.19	< .001	.86
12	.20	–.08	< .001	.89
13	.18	–.26	< .001	.93
14	.12	–.21	< .001	.94
15	.09	–.15	< .001	.90
16	.10	–.14	< .001	.93
17	.07	–.04	< .001	.94
18	.13	–.21	< .001	.93
19	.20	–.11	< .001	.86
20	.24	–.18	< .001	.86
Creativity	Skewness	Kurtosis	D-index	Corrected item-total correlation
21	.13	.07	< .001	.89
22	.15	.10	< .001	.92
23	.17	.23	< .001	.91
24	.19	.15	< .001	.90
25	.16	.11	< .001	.93
26	.07	–.01	< .001	.93
27	.02	.07	< .001	.92
28	.22	.28	< .001	.87
29	.11	.23	< .001	.86
30	.14	.23	< .001	.86

(Table 2 continues)

Table 2 (continued)

Leadership	Skewness	Kurtosis	D-index	Corrected item-total correlation
31	.18	–.01	< .001	.78
32	.01	.07	< .001	.84
33	–.08	.16	< .001	.86
34	.16	–.06	< .001	.87
35	–.05	.11	< .001	.87
36	.13	.05	< .001	.90
37	.18	–.10	< .001	.84
38	–.07	–.04	< .001	.88
39	.07	–.04	< .001	.83
40	.01	–.16	< .001	.84
Artistic talent	**Skewness**	**Kurtosis**	**D-index**	**Corrected item-total correlation**
41	.04	.57	< .001	.88
42	.10	.57	< .001	.93
43	.02	.50	< .001	.91
44	.08	.49	< .001	.92
45	.09	.96	< .001	.87
46	.18	.33	< .001	.93
47	.03	.66	< .001	.93
48	.12	.49	< .001	.92
49	.12	.34	< .001	.90
50	.12	.37	< .001	.92

To verify the internal consistency, Cronbach's alpha was used to measure split-half reliability; the alpha coefficients ranged from .92 to .99, showing excellent reliability and certifying the quality of the instrument and all of its individual subscales (see Table 3).

TABLE 3
Average Cronbach's alpha reliability coefficient in total sample (N = 925)

	General intellectual ability	Academic skills	Creativity	Leadership	Artistic talent
α	.99	.98	.97	.96	.92

To determine whether the results of the GATES-2 are stable over time, the raters completed the GATES-2 twice, approximately 4 weeks apart, on 24 subjects. The findings showed good levels of correlation between the raw scores obtained in the two evaluations, ranging from .66 for the artistic talent subscale to .84 for the creativity subscale (see Table 4). The differences between the means scores of the two evaluations were not statistically significant, which suggests that the GATES-2 has an adequate test-retest reliability for use as a tool in identifying gifted and talented individuals.

TABLE 4
Mean and standard deviation (raw scores) and test-retest correlation in a subsample (N = 24)

	Time 1	Time 2	*r*	*F*	*p*
	M (*SD*)	*M* (*SD*)			
General intellectual ability	55.42 (12.51)	53.33 (10.94)	.80	1.89	.19
Academic skills	54.71 (11.47)	54.50 (9.73)	.72	0.16	.90
Creativity	53.71 (12.07)	52.79 (10.73)	.84	0.45	.51
Leadership	53.67 (8.33)	52.96 (6.53)	.71	0.34	.56
Artistic talent	51.63 (9.66)	51.67 (9.04)	.66	0.001	.97

Psychometric Characteristics of the GATES-2 Scales: Validity

Confirmatory factor analysis. The Italian test manual provides evidence in support of internal structure and convergent and divergent validity (Bianchi di Castelbianco et al., 2019), including the factorial analysis on normative sample. Confirmatory factor analyses were carried out; goodness of fit is evaluated using a range of model fit indices, which assess the relationship between the observed data and the theoretical data which would be expected from the model. The following fit indices are considered: chi-square test and chi-square value to the degrees of freedom index, root mean square error of approximation (RMSEA), comparative fit index (CFI), Tucker-Lewis index (TLI), Akaike information criteria (AIC) and Bayesian information criteria (BIC). The latter two coefficients do not provide absolute information on the good adaptation of the data to the theoretical model, but their comparison allows to understand which of these models has a better adaptation to the data (the lowest value). The CFI and the TLI produce values between 0 and 1; values > .90 are indicative of good fit. A good fit is also indicated when RMSEA value is .08 or lower (Hu & Bentler,1999). As in the original version of the GATES-II, three different models are tested: a single-factor model, a four-factor model, and a five-factor model, reflecting the structure of the original test consisting of five different subscales. The results presented in Table 5 show that the single-factor model is not deemed acceptable. The four- and five-factor models have similar index values: the five-factor model, however, shows slightly higher values of CFI and TLI, and lower values of RMSEA, AIC, and BIC. Nevertheless, they are not entirely acceptable, therefore four covariates are included. This new model, composed therefore from five factors and four covariates between four couples of items error terms, shows a good adaptation.

TABLE 5
Goodness of fit of confirmatory analysis

Model	χ^2	*df*	*p*	AIC	BIC	CFI	TLI	RMSEA [90% CI]
Single-factor	46263.38	1178	<.001	143551.51	144274.51	.41	.38	.21 [.20, .21]
Four-factors	11745.97	1173	<.001	109038.10	109770.75	.86	.86	.10 [.10, .10]
Five-factors	10670.67	1170	<.001	107968.80	108715.90	.88	.87	.09 [.09, .10]
Five factors + four covariates	8714.02	1166	<.001	106020.15	106789.53	.90	.90	.08 [.08, .09]

Note. *df* = degrees of freedom; AIC = Akaike's information criterion; BIC = Bayesian information criteria; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; CI = confidence interval.

In detail, only covariates between error terms of items that belong to the same factor were added; these items shared a large amount of variance: theoretically, it's possible when two items contain the same words or measure the same aspect of the construct like in these cases (i.e., General ability, Item 8: "Shows excellent memory skills"; Item 9: "Demonstrates ability to retain large amount of information"; Academic skills, Item 11: "Mantains intense interest in a subject"; Item 12: "Demonstrates considerable knowledge of a specific academic area"). Moreover, all factor loadings were statistically significant and higher than .30 (Table 6).

TABLE 6
Factor loadings and items error terms' covariates from the CFA (final model)

	General intellectual ability GIA	Academic skills AS	Creativity Cr	Leadership Le	Artistic talent AT
GIA 1	.86				
GIA 2	.93				
GIA 3	.92				
GIA 4	.88				
GIA 5	.86				
GIA 6	.91				
GIA 7	.93				
GIA 8	.87				
GIA 9	.87				
GIA 10	.85				
AS 1		.77			
AS 2		.82			
AS 3		.90			
AS 4		.82			
AS 5		.85			
AS 6		.90			
AS 7		.93			
AS 8		.89			
AS 9		.77			
AS 10		.76			
Cr 1			.47		
Cr 2			.93		
Cr 3			.92		
Cr 4			.92		
Cr 5			.94		
Cr 6			.94		
Cr 7			.93		
Cr 8			.88		
Cr 9			.86		
Cr 10			.87		

(Table 6 continues)

Table 6 (continued)

	General intellectual ability GIA	Academic skills AS	Creativity Cr	Leadership Le	Artistic talent AT
Le 1				.71	
Le 2				.82	
Le 3				.84	
Le 4				.89	
Le 5				.85	
Le 6				.92	
Le 7				.87	
Le 8				.87	
Le 9				.84	
Le 10				.86	
AT 1					.83
AT 2					.92
AT 3					.89
AT 4					.90
AT 5					.95
AT 6					.93
AT 7					.92
AT 8					.92
AT 9					.89
AT 10					.91
Items error terms' covariates					
GIA 8 – GIA 9	.65				
AS 1 – AS 2	.55				
AS 8 – AS 9	.76				
Le 3 – Le 5	.65				

Chronological age. The chronological age of children (N = 925) was correlated to GATES-2 standard scores. As expected, very low or not significant correlations emerged in the five subscales: general intellectual ability (r = .07, p < .05), academic skills (r = .12, p < .001), creativity (r = .08, p < .05), leadership (r = .18, p < .001), and artistic talent (r = .00, p = .62).

Gender differences. Multivariate analysis of variance (MANOVA) was conducted to verify the effect of the gender variable on the scores obtained in the GATES-2 subscales (Wilks' Lambda = .922, p < .001). The findings show statistically significant differences between scores in the leadership and artistic talent subscales, where females obtained higher scores than males (Table 7).

Intercorrelations between subscales. More similar subscales should show higher correlations than subscales which, from a theoretical point of view, were less similar. In fact, the highest correlations emerged between academic skills and general intellectual ability (.94), between creativity, academic skills, and general intellectual abilities (.84), between leadership, academic skills, general intellectual ability, and creativity (from .77 to .81). The artistic talent subscale showed moderate correlations with the other subscales (from .56 to .64).

TABLE 7
Gender effect on GATES-2 scores subscales (N = 925)

	Male *M* (*SD*)	Female *M* (*SD*)	*F*	*p*	*d*-Cohen
General intellectual ability	53.03 (15.97)	54.69 (15.98)	.758	.384	/
Academic skills	53.91 (15.29)	55.21 (15.53)	.710	.400	/
Creativity	51.48 (14.98)	53.00 (14.48)	1.422	.233	/
Leadership	52.49 (14.07)	55.99 (14.22)	6.836	.009	.25
Artistic talent	47.82 (13.91)	55.14 (13.85)	57.838	.000	.51

Note. $d \leq .20$ = small; $.21 \leq d \leq .50$ = moderate; $.51 \leq d \leq .80$ = medium; $d \geq .81$ = high.

Academic performance. Correlations between school grades and GATES-2 scores were investigated. For a subgroup of 400 students, the school grades obtained in the last report or in the summary document of the schools were requested. The grades in the subjects of Italian, Mathematics, History, Geography, Science, English, Art, and Physical Education were taken into consideration, being in common for students in primary and secondary schools. Data analysis showed significant correlations between all subscales and the school grades: general intellectual ability showed higher correlations with Italian grades (r = .41, p < .001) and Math grades (r = .39, p < .001), and lower correlations with Art grades (r = .16, p < .01). Academic skills showed higher correlations with Italian grades (r = .40, p < .001) and Math grades (r = .40, p < .001), and lower correlations with Physical Education grades (r = .14, p < .01). Creativity showed higher correlations with Italian grades (r = .36, p < .001) and Geography grades (r = .32, p < .001), and lower correlations with Physical Education grades (r = .18, p < .01). Leadership showed higher correlations with Geography grades (r = .36, p < .001), and no correlation with Art grades (r = .06, *ns*). Finally, Artistic talent showed higher correlations with Math grades (r = .32, p < .001) and Art grades (r = .32, p < .001), and lower correlations with Physical Education grades (r = .22, p < .01).

These correlation values increased when calculated on the subgroup of 174 primary school children: the correlations between school grades and general intellectual ability ranged from r = .60 (Math) to r = .48 (English); correlations with academic skills ranged from r = .57 (Math) to r = .47 (English); the correlations with creativity ranged from r = .49 (Math) to r = .34 (Science); the correlations with leadership ranged from r = .54 (Geography) to r = .38 (English); and the correlations with artistic talent ranged from r = .33 (Italian) to r = .19 (Science).

Fluid Reasoning (CPM and CFT-20R)

Children aged 5 to 7 years, 11 months old (N = 240) were administered, in a collective form, the CPM (Belacchi et al., 2008) and students aged 8 to 18 years old (N = 699) were administered the CFT 20-R scales (Saggino & Tommasi, 2019), both of which are useful for the evaluation of IQ in terms of fluid reasoning. As can be seen in Table 8, the IQ scores measured with the CPM have a significant correlation, albeit of low intensity, with all of the subscales of GATES-2. Correlations for older students (assessed with CFT 20-R) are significant and moderate. This suggests that in general, fluid reasoning skills are correlated, but not coincident, with more strictly didactic skills (general intellectual ability and academic skills), but they are less so with the characteristics of creativity, leadership, and artistic talent in pupils.

TABLE 8
D correlations between GATES-2 scores and CPM scores (N = 240), CFT 20-R scores (N = 699), WPPSI-III scores (N = 22), and WISC-IV/WAIS-IV (N = 175)

	General intellectual ability	Academic skills	Creativity	Leadership	Artistic talent
CPM_IQ	.21**	.24***	.20**	.18**	.16*
CFT 20R_IQ	.30***	.32***	.25***	.26***	.21***
WPPSI_FSIQ	.12	.55**	.11	.15	–.29
VIQ	.13	.43*	.12	.10	–.27
PIQ	.61**	.49*	.38	.40	–.04
PSQ	.73**	.51*	.44*	.49*	–.02
WISC/WAIS_FSIQ	.23**	.27**	.28**	.29**	.19*
VCI	.35**	.37**	.43**	.32**	.15
PRI	.10	.11	.13	.04	.19*
WMI	.06	.12	.09	.22**	.05
PSI	–.04	.03	–.08	.12	–.01

Note. CPM_IQ = intelligence quotient score obtained at Colored Progressive Matrices; CFT 20-R_IQ = intelligence quotient score obtained at the Cattell Fluid Test; WPPSI = Wechsler Preschool and Primary Scale of Intelligence; FSIQ = Full Scale Intelligence Quotient; VIQ = Verbal Quotient; PIQ = Performance Quotient; WISC = Wechsler Intelligence Scale for Children; WAIS = Wechsler Adult Intelligence Scale; PSQ: Processing Speed Quotient; VCI = Verbal Comprehension Index; PRI: Perceptual Reasoning Index; WMI = Verbal Memory index; PSI = Processing Speed Index.
* $p < .05$. ** $p < .01$. *** $p < .001$.

The differences between the standard scores obtained on the GATES-2 by students with a fluid reasoning IQ score ≥ 130 (N = 55) and those with an IQ < 130 (N = 817) were also analyzed. A CPM or CFT 20-R IQ score ≥ 130 was chosen as an index of cognitive functioning extremely above average (≥ 2 *SD* from the mean).

The results show the presence of significant differences in all subscales, except for leadership: subjects with IQ ≥ 130 in fluid reasoning obtained higher scores on the GATES-2 than subjects with an IQ < 130. These data indicate the good discriminatory capacity of the GATES-2 (Table 9).

TABLE 9
Differences between groups with IQ ≥ 130 (N = 55) and IQ < 130 (N = 817) on GATES-2 standard scores

	IQ < 130		IQ < 130		
	M	*SD*	*M*	*SD*	*p*
General intellectual ability	98.8	14.1	103.2	13.7	< .05
Academic skills	98.8	14.3	103.7	12.6	< .05
Creativity	98.7	14.1	103.6	13.1	< .05
Leadership	98.7	14.3	101.8	14.5	.13
Artistic talent	98.7	13.9	103.6	11.4	< .05

Note. IQ = intelligence quotient score.

Multifactorial Intelligence (WPPSI-III, WISC-IV, and WAIS-IV)

The Wechsler scales for measuring multifactorial intelligence were administered to a subgroup of students who scored higher than 120 in the fluid reasoning tests. The correlations between IQ and the GATES-2 scores were calculated: significant correlations emerged in the preschool group (n = 22) between the WPPSI-III Full Scale IQ scores and the GATES-2 academic skills scores, between the WPPSI-III Verbal Quotient and the academic skills scores, between the WPPSI-III Performance Quotient and the general intellectual ability and academic skills scores, and finally, the WPPSI-III Processing Speed Quotient correlated with all subscales of the GATES-2, with the exception of artistic talent (Table 6). In the group of students aged 6 to 18 years (n = 175), there emerged moderately significant correlations between the full IQ scores from the WISC-IV or WAIS-IV and the GATES-2 scores. Among the indices of the cognitive scales, the Verbal Comprehension Index (VCI) correlated most with creativity and did not correlate with artistic talent. On the contrary, the Perceptual Reasoning Index (PRI) only correlated with artistic talent; the Verbal Memory Index (WMI) and Processing Speed Index (PSI) did not show significant correlations with any area of the GATES-2 for this age cohort.

DISCUSSION

The present study investigated the psychometric characteristics of the Italian version of the GATES-2, a tool compiled by teachers to identify talented and gifted students, in a sample of 925 pupils attending kindergarten, primary, first-, and second-grade schools, who participated in the Italian adaptation of the instrument. From the analysis conducted to verify the reliability of the test, it emerged that the GATES-2 items have an adequate discriminatory capacity (D-index and item-total correlation); the reliability coefficients of the GATES-2 were similar to those described in other similar tests (GRS-S; Pfeiffer & Petscher, 2008). This indicates that the GATES-2 items are able to differentiate pupils with low and high levels of ability in each of the individual subscales. Within the analysis of reliability, the test-retest correlation was also carried out; although the subsample was small, the stability of the results appeared adequate; artistic talent is the subscale that showed the lowest correlation value (r = .66), probably because it evaluates the student's attitudes toward the arts, such as acting, music, singing, dance, drawing, painting, sculpture, and so forth. Therefore, it could be a subscale more susceptible to the interpretation of the teacher. For this reason, at least in Italy, the GATES-2 test is distributed with a video-training course; in this way the personal and interpretation bias should be minimized.

Consistent with previous studies (Gilliam & Jerman, 2015; Pfeiffer & Jarosewich, 2007), from the analysis conducted to verify the validity of the test, very low or no significant correlations emerged between the chronological age of the students and the scores on the individual subscales. This may be due both to the fact that giftedness can be considered a stable characteristic over time (Pfeiffer & Jarosewich, 2007) and to the fact that the test is constructed in such a way that the age variable is already taken into consideration during the attribution of the raw score: when the score is attributed to an item, it is necessary to give a judgment on the abilities of the child or young person "compared to the average of the students of his age." To evaluate the validity of the test, also the analyses of intercorrelations between subscales were carried out; we expected that more similar subscales should show higher correlations than subscales which, from a theoretical point of view, were less similar. The high correlations between academic skills and general intellectual ability, between creativity and academic skills/general intellectual ability, between leadership and academic skills/general intellectual ability/creativity, further confirm the validity of the test, in line with the theoretical assumption that subscales pertaining to the same conceptual domain are more correlated. These findings are consistent with previous studies (Pfeiffer et al., 2008); they found inter-relations ranging from .66 between artistic talent and leadership to .95 between academic and general intellectual ability. The pattern of intercorrelations is consistent with a multidimensional conception of giftedness with an underlying general ability *g* common factor. In fact, the factor analysis of the standardization sample found that items on the subscales loaded on one principal factor. Only the artistic talent subscale showed moderately (though greater than .60) correlations with the other subscales; this finding indicates, on the one hand, a significant relationship between "Giftedness" and "Talent," on the other, reflects a common (but not shared) distinction between the two constructs. As Winner (1996) describes, they master the first steps in their domain at an earlier than average age and learn more rapidly in that domain; they are intensely motivated to make sense of their domain, and show an obsessive interest and ability to focus sharply in their area of high ability; third, they do not just learn faster than ordinary children, they also learn differently, often solve problems in their domain in novel, idiosyncratic ways.

Future GATES-2 research may be able to help answer the related questions of whether we can reliably measure the multiple manifestations of giftedness and if one underlying *g* factor explains most of the reliable variance accounted for in a student's ratings.

Gender differences did, however, emerge, so the average GATES-2 scores were significantly higher in the females of our sample in the leadership and artistic talent subscales. These data are consistent with what has already been found, for example, in the GRS-P (Pfeiffer et al., 2007) and GRS-S (Pfeiffer et al., 2008); in these cases too, females scored significantly higher in different subscales (artistic talent, leadership, and motivation). Today there are no clear hypotheses that justify gender differences in gifted people; some studies (Lubinski et al., 2014; Zeidner & Shani-Zinovich, 2011) have tried to investigate gender differences in noncognitive characteristics of gifted students, finding that gifted males and females differed very little with respect to self-awareness, locus of control, and performance anxiety. We believe, in line with other authors (Matheis et al., 2020), that there may be a different intensity with which students express their interests and skills in the school context. For example, some authors have found that gifted female students reported studying more, wanting to work harder at school, and wanting to get high grades compared to their male peers (Roznowski et al., 2000). Another aspect that could have influenced the identification of gender differences lies in the subjective theories that teachers have about students with talent; because teachers play a vital role in identifying gifted students in school, if this identification is based primarily on the manifestation of high intelligence and on students' academic achievement (Endepohls-Ulpe & Ruf, 2006), this could lead teachers to perceive the skills of males differently from those of females. Based on these reflections, we believe it is important that tools such as GATES-2 take into account any cultural or contextual bias, and therefore have a differentiated calibration based on gender to minimize possible interference due to user perception. In confirmation of what has just been said, to evaluate the validity of the tool, we also analyzed the correlations between school grades and the scores obtained in the GATES-2 in a subgroup of the sample. The low or moderate correlations that emerged ($r < .40$) suggest that being recognized as a probable high-potential student does not coincide with high academic achievement.

This relationship appears stronger in primary school, where correlation scores reach .60, indicating a greater correspondence between academic performance and the ability of a teacher to identify probable talent. A recent meta-analysis conducted on the relationship between intelligence and school grades (Roth et al., 2015) analyzed over 160 studies published between 1922 and 2014. The main result of the meta-analysis reports a correlation average of .54 between intelligence and school grades, similar to what was previously reported by others (Gottfredson, 2002; Sternberg et al., 2011). This in general suggests that there is a good portion of pupils who may not perform brilliantly and who are less likely to be recognized by teachers as people with talent (Landis & Reschly, 2013).

When assessment with the GATES-2 scales was correlated with standardized cognitive tests that evaluate fluid reasoning skills, moderate correlations emerged. This suggests that fluid reasoning skills are correlated, but not coincident, with school skills (general intellectual ability and academic skills), and they are even less so with the characteristics of creativity, leadership, and artistic talent among pupils. In any case, students with an IQ score ≥ 130 in fluid reasoning obtain significantly higher scores in all subscales of the GATES-2 than subjects with an IQ < 130, which confirms the instrument's good ability to discriminate between normal and above the norm abilities in the school context. Finally, when assessment with the GATES-2 scales is related to standardized multicomponent cognitive tests, it emerged that, in children aged 5 to 6 years, the cognitive ability that correlated with most of its subscales is processing speed, which is the ability to carry out repeated cognitive activities quickly and automatically. In older students (aged 6 to 18 years), on the other hand, the cognitive ability that correlated the most with the GATES-2 subscales is verbal comprehension — that is, the good knowledge of vocabulary and verbal reasoning. These findings can be explained by the fact that verbal skills have a progressively increasing weight in the upper school classes, in the processing of written texts or in the oral questions, which in turn are the basis for a good school grade. The correlations between the scores for the GATES-2 and the cognitive tests can be considered moderate, and reaffirm that the GATES-2 serves the purpose of integrating cognitive assessment (carried out by the clinician), enriching the observation perspective, and providing new additional information to the student and his or her family.

Limitations

This research has some limitations, including the absence of multigroup confirmatory factor analysis to verify the construct structure and, for instance, to check the invariance across different subpopulations; it will be interesting to implement the research to verify these factors. Despite the adequacy of the factor structure, some issues are still open: in particular, further studies are needed in order to check the dimensionality of the test due to the introduction of four covariates between items error terms, that reduce the interpretability of the solution, even though this introduction is theoeretically justified. Another limitation concerns the low sample size used for test-retest analysis, so some results (such as those in the artistic talent dimension) may be difficult to interpret. It would be useful to increase the number of subjects in a further study. In addition, while we found high correlations between dimensions, artistic talent showed a lower correlation value, probably because it is the subscale more susceptible to the interpretation of the respondent. Future GATES-2 research may be able to help answer these limitations.

Conclusions

The present study described the psychometric properties of the Italian version of GATES-2, the first standardized tool in Italy compiled by teachers to identify skills and talent in the school context. The data from the present study suggest that the GATES-2 can provide a new and different perspective to teachers that would meet their need to acquire more cognitive tools on giftedness and talent. Similarly, if used in the ordinary educational and pedagogical process, the GATES-2 would allow teachers to individualize school programs more effectively, for example, by enhancing any student strengths highlighted by the tool. Finally, the GATES-2 also contributes to bridging the gap between the need for information coming from the educational context and the lack of tools that allow these observations from both multi-method (integrating information from different tools) and multi-informant (involving professionals operating in different fields in the role of informants) assessment perspectives.

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